TB141350 C

B. Sc. DEGREE (C. B. C. S. S.) EXAMINATION, NOVEMBER 2014

B. Sc. MATHEMATICS - FIRST SEMESTER

COMPLEMENTARY COURSE (PHYSICS)

PHY1PMMFA – PROPERTIES OF MATTER, MECHANICS AND FOURIER

ANALYSIS

Time: 3 Hours　　　　　　　　　　　　　　　　**Maximum: 60 Marks**

Part A (Short Answer Questions)

Answer all questions (Each question carries 1 mark)

1. What are plastic bodies?

2. What do you mean by angle of shear?

3. What is meant by rigid body?

4. Define SHM with one example.

5. Define moment of inertia. Write the mathematical expression representing moment of inertia.

6. Write an expression for total energy of a harmonic oscillator and explain its dependence on parameters of SHM motion.

7. What are harmonics of a wave?

8. What is logarithmic decrement?

$(8 \times 1 = 8$ marks$)$

Part B (Brief Answer Questions)

Answer any six questions (Each question carries 2 marks)

9. Explain neutral surface of a beam.

10. Why hollow cylinders are preferred over solid ones in shafts?

11. What are meant by elastic fatigue and elastic after effect?

12. Define the following terms in SHM. (i) Amplitude   (ii) Frequency   (iii) Time period
(iv) Angular frequency.

13. Derive expressions for velocity and acceleration of a body executing SHM. Represent
graphically their variations with time.

14. Find the moment of inertia of a thin uniform rod about an axis passing through the centre
and perpendicular to its length. Also find the moment of inertia about an axis passing at
one end and perpendicular to its length.

15. Derive the expression for angular momentum of rigid body.

16. State and prove parallel axes theorem.

17. What are Dirichlet's conditions? Explain with an example.

18. What is flexural rigidity?

$(6 \times 2 = 12$ marks$)$

Part C (Problems/Derivations)

Answer any four questions (Each question carries 4 marks)

19. Test the following decay for violation of the conservation of electric charge, baryon
number and lepton number.

$$\pi^0 \longrightarrow e^+ + e^- + \gamma$$
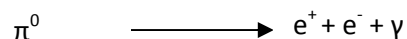
20. Find the moment of inertia of a rod about an axis through its centre and perpendicular to
its length.

21. A bar 0.01m square in cross-section is supported on two knife edges 1m apart. A load of
1kg at the centre of the bar producers a depression of the midpoint of the bar by
2.5×10^{-3}m. Find the Young's modulus of the material of the bar.

22. A wheel of moment of inertia 5×10^{-2} kg-m^2 is making 10 rotations per minute. What
amount of work is needed to make it rotate 5 times faster?

23. The displacement of a harmonic oscillator is given by $x = 6 \sin (40 \, t + \frac{\pi}{4})$. Find its amplitude, time period, frequency and initial phase. Find also its velocity when the particle is at a distance 2cm from the extreme position.

24. What couple must be applied to a wire of length 0.8m and radius 0.6mm to produce a twist of 60° at one end, while the others end is fixed. Rigidity modulus of the material of the wire is 135.5 GPa.

(4 × 4 = 16 marks)

Part D (Long answer/ Problem questions)
Answer any two questions (Each question carries 12 marks)

25. Explain moment of inertia. Also define radius of gyration. State and prove parallel and perpendicular axes theorems.

26. Describe with necessary theory the torsion pendulum method of determining the rigidity modulus of the material of a wire.

27. What is meant by driven harmonic oscillations? Deduce the differential equation of driven harmonic oscillator. Discuss the amplitude resonance and sharpness of resonance.

28. Give the quark model of elementary particles.

(2 × 12 = 24 marks)